

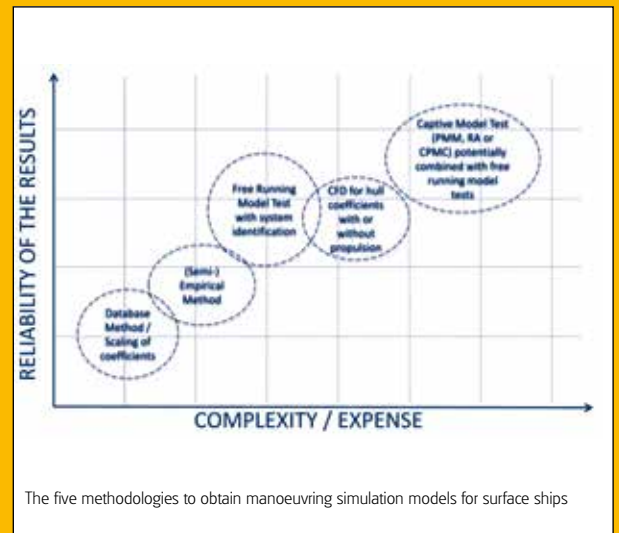
Accurate calculation models for manoeuvring simulations

Traditionally, simulation models are based on forces measured during (captive) model tests. However, over the past decades, more methodologies have become available.

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Example of a ship being tested with the use of MARIN's computerised planar motion carriage. This methodology works for model sizes between 2 and 10 metres



The five methodologies to obtain manoeuvring simulation models for surface ships

MARIN strives to have all these methodologies in-house and up-to-date. The preferred methodology to determine a manoeuvring model is dependent on the required accuracy for the study, the risk and the reliability of the prediction for the ship type. Additionally, the environment and time schedule of the customer are important considerations.

The following methodologies are used to arrive at simulation models for surface ships.

- The database method uses existing, well-trusted simulation models and scales coefficients to arrive at a new simulation model. When the target ship is very close to ships for which there is already a lot of information available, the methodology is reliable and the results can be used for feasibility studies.

- Semi-empirical methods are using hull, rudder and propeller data to determine manoeuvring properties. These methodologies have more flexibility: unconventional ship hulls can be addressed for example, at least as long as the shape of the hull is not too far from the data on which the semi-empirical method is based.
- Free running model tests are a well-known and highly reliable way of obtaining manoeuvring trajectories. In the latest development, a simulation model is created by improving a semi-empirical method by system identification using the results of the free running tests.
- CFD use for manoeuvring simulation models has been a long-term development at MARIN and recent results show that these methods work well¹.

- Captive model tests have been used since the 1960s. Over the last years, MARIN has been investigating quasi-stationary tests, which has led to an efficiency gain².

By having many technical possibilities in the portfolio, as well as insight into the applicability and validity, MARIN can objectively recommend the best way to obtain a simulation model to its customers. ▢

¹ Review of the SIMMAN2014 Workshop on the State of the Art of Prediction Techniques for Ship Manoeuvrability', Quadvlieg

² 'Instationary Captive Model Tests', Hallmann & Quadvlieg, MARSIM 2015